WHAT IS CLAIMED IS:

1. A system for detecting curvature in a towed hydrophone array, said system comprising:

at least two curvature sensors positioned along the length of the array; and

each of said curvature sensors comprising a bend member which bends as the array bends, at least one optical fiber within the bend member, and at least one detection device embedded within said at least one optical fiber to detect a change in strain in said at least one optical fiber.

2. A system according to claim 1 wherein said bend member comprises a bend rod and wherein said curvature sensor has at least three optical fibers embedded within said bend rod.

3. A system according to claim 2 wherein said bend rod has a length and each of said optical fibers runs longitudinally down the length of the bend rod and wherein said optical fibers are radially distributed around the perimeter of the bend rod.

4. A system according to claim 2 wherein said at least one detection device comprises at least one optical fiber Bragg grating embedded in each of said optical fibers.

5. A system according to claim 2 wherein said at least one detection device comprises more than one optical fiber Bragg grating embedded in each of said optical fibers.

6. A system according to claim 5 wherein each of said optical fiber Bragg gratings operates at a different wavelength.

7. A system according to claim 2 wherein said at least one detection device comprises at least one optical fiber Bragg grating laser embedded within each of said optical fibers.

8. A system according to claim 2 wherein said at least one detection device comprises more than one optical fiber Bragg grating laser embedded within each of said optical fibers.

9. A system according to claim 8 wherein each of said optical fiber Bragg grating lasers operates at a different wavelength.

10. A system according to claim 2 wherein said array has a hose wall and further comprising means for coupling first and second ends of said bend rod to said hose wall.

11. A system according to claim 10 wherein said coupling means comprises a pair of rigid pieces.

12. A system according to claim 2 wherein said bend rod is placed within a mount assembly.

13. A system according to claim 11 wherein said mount assembly comprises a cylindrical structure having a free center and an off axis slot for receiving said bend rod.

14. A system according to claim 11 further comprising said mounting assembly being mounted within the array by a plurality of internal stringers.

15. A system according to claim 11 further comprising a gap between an outer surface of said bend rod and inner surface of said mount assembly and said gap being selected so that at a certain maximum curvature the bending of the bend rod is limited by the mount assembly and so that the optical fibers and the

detection devices experience no further strain at smaller bend diameters.

16. A system according to claim 1 wherein said bend member comprises a bend rod and said at least one optical fiber comprises a single optical fiber within said bend rod.

17. A system according to claim 15 wherein said single optical fiber has a serpentine configuration with a plurality of legs and wherein each of said legs has a detection device embedded within said leg.

18. A system according to claim 16 wherein said detection device comprises an optical fiber Bragg grating.

19. A system according to claim 16 wherein said detection device comprises an optical fiber Bragg grating laser.

20. A system according to claim 1 wherein said bend member comprises a bend cylinder having a plurality of optical fibers embedded therein.

21. A system according to claim 19 further comprising: a mount assembly inside said bend cylinder; a gap between an inner

surface of said bend cylinder and an outer surface of said mount assembly; and said gap being sized to limit the bending of said optical fibers.

22. A system according to claim 19 wherein said at least one detection device comprises an optical fiber Bragg grating embedded within each said optical fiber.

23. A system according to claim 19 wherein said at least one detection device comprises an optical fiber Bragg grating laser embedded within each said optical fiber.

24. A curvature sensor comprising:

a bend member;

at least one optical fiber within the bend member; and

at least one detection device embedded within said at least one optical fiber to detect a change in strain in said at least one optical fiber.

25. A curvature sensor according to claim 23 wherein said at least one detection device comprises an optical fiber Bragg grating.

26. A curvature sensor according to claim 23 wherein said at least one detection device comprises an optical fiber Bragg grating laser.

27. A curvature sensor according to claim 23 wherein each said optical fiber has a plurality of detection devices embedded therein.

28. A curvature sensor according to claim 26 wherein each of said detection devices operates at a different wavelength.

29. A curvature sensor according to claim 23 wherein said bend member comprises a bend rod and said at least one optical fiber comprises a single optical fiber having a serpentine configuration with a plurality of legs.

30. A curvature sensor according to claim 28 wherein each of said legs has a detection device incorporated therein.

31. A curvature sensor according to claim 23 wherein said bend member comprises a bend rod and wherein said curvature sensor has at least three optical fibers embedded within said bend rod.

32. A curvature sensor according to claim 30 wherein said bend rod has a length and each of said optical fibers runs longitudinally down the length of the bend rod and wherein said optical fibers are radially distributed around the perimeter of the bend rod.

33. A curvature sensor according to claim 23 wherein said bend member comprises a bend cylinder and wherein said curvature sensor has a plurality of optical fibers embedded within said bend cylinder.

34. A system for determining the curvature and shape of a towed hydrophone array comprising:

a plurality of curvature sensors positioned along the length of the array;

each of said curvature sensors comprising a bend member which bends as the array bends, at least one optical fiber within the bend member, and at least one

detection device embedded within said at least one optical fiber to detect a change in strain in said at least one optical fiber; and

a plurality of roll sensors positioned along the length of the array with each of said roll sensors being in close proximity to a respective one of said curvature sensors.